Space Weather Forecast

Issued on Monday 6 January 2025 at 13:13 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate-class flares expected, with a slight chance of Strong-class flares. Slight chance of a glancing CME late 6th or early 7th Jan, with a G1 Minor geomagnetic storm possible.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with three Moderate-class flares observed, all originating from an active region in the northeast of the visible disc.

There are currently ten sunspot regions on the visible disc. Despite the number of spots on the Earth facing-disc, many are small and generally magnetically simple, with most showing little signs of significant growth or some slight decay in the last 24 hours. A complex spot in the northeast is the largest and most complex spot and has been responsible for the bulk of recent activity, with three strong class flares now recorded since appearing on the solar disc. A region in the southwest, though currently magnetically simple, saw two Common-class flares, one at 04/1444 UTC and another at 04/1827 UTC that generated significant coronal mass ejections (CMEs) on 04 Jan but has since remained relatively stable and soon to rotate of the western limb. It is likely both of these CMEs will pass ahead of Earths orbit, however there is a slight chance that the latter CME may deliver a glancing blow late on Day 1 (06 Jan) or early on Day 2 (07 Jan).

No new Earth-directed CMEs were observed in available coronagraph imagery.

Solar Wind / Geomagnetic Activity: Solar wind speeds observed by ACE at L1 were strong at 700km/s at the start of the period, but have since declined to elevated levels, currently near 550km/s. This is due to a connection with a coronal hole fast wind. The Interplanetary Magnetic Field (IMF) has been weak to moderate. The north-south component, Bz, fluctuated between negative and positive through much of the period. Geomagnetic activity was mainly Unsettled to Active (Kp3-4) throughout the period.

Observed solar wind speeds were elevated at around 580-600km/s slowly declining to 530km/s as a connection to fast winds fades. The Interplanetary Magnetic Field (IMF), has been weak. The north-south component, fluctuated between weakly negative and positive through much of the period.

Geomagnetic activity was mainly Unsettled to Active (Kp3-4) throughout the period.

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Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES-18 was close to the S1 Minor Storm threshold at the start of the period, with a brief peak at 1.0pfu, slowly trending downwards from 05/1800 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Activity is forecast to be Moderate to High, with further Moderate flares expected and a slight chance of further isolated strong flares, mainly from the complex region in the northeast.

Solar Wind / Geomagnetic Activity: There is a slight chance of a glancing blow from a CME (Coronal mass ejection) later on Day 1 (06 Jan) or early on Day 2 (07 Jan), but it is more likely the CME will pass ahead of Earth's orbit. Earth's connection to a high speed stream is expected to wane over the next few days. Elevated solar winds are likely to slowly decline on Day 1 (06 Jan), perhaps returning to background levels by Day 3 (08 Jan).

Geomagnetic conditions are expected to be mainly quiet to unsettled (Kp1-3) through the period, with a slight chance of a few active or G1 Minor geomagnetic storm intervals (Kp4-5) initially in association with the HSS and also later Day 1 (06 Jan) or early Day 2 (07 Jan) if a glancing blow occurs from the aforementioned CME.

Geomagnetic conditions are expected to be mainly Quiet to Unsettled (Kp1-3) through the period, some Active (Kp4) intervals likely with a slight chance of a G1 Minor geomagnetic storm interval (Kp5) later Day 1 (06 Jan) or early Day 2 (07 Jan) if a glancing blow occurs from the aforementioned CME. Quiet to Unsettled conditions are expected on Days 3 and 4 (08-09 Jan) as the connection to the high speed stream and possibly any lingering glancing CME effects continues to wane.

Energetic Particles / Solar Radiation: The count rate of energetic particles (high energy protons) has now decreased back below the S1 threshold after recent enhancement. There is a slight chance of further enhancement over the next few days should any further significant flares occur from the west of the disc.

Geomagnetic Storms

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	No	20	20	1	1
Strong	**G3**	No	1	1	1	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

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Radio Blackouts - X-Ray Flares

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	80	80	80	80
Very Active	R3-R5 (X Class)	No	20	20	20	20

Solar Radiation Storms (High Energy Protons)

Radiation Storms	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	20	20	20	20
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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